(12) UK Patent Application (19) GB (11) 2 211 685 (13) A

(43) Date of A publication 05.07.1989

(21) Application No 8823917.3

(22) Date of filing 12.10.1988

(30) Priority data
(31) 8725240 (32) 28.10.1987 (33) GB

(71) Applicant
Ian Grenville Thomas
16 Storrs Hall Road, Walkley, Sheffield, S6 5AW, United Kingdom

(72) Inventor
Ian Grenville Thomas

(74) Agent and/or Address for Service
Mewburn Ellis
2 Cursitor Street, London, EC4A 1BQ, United Kingdom

(51) INT CL⁴
H03G 3/20

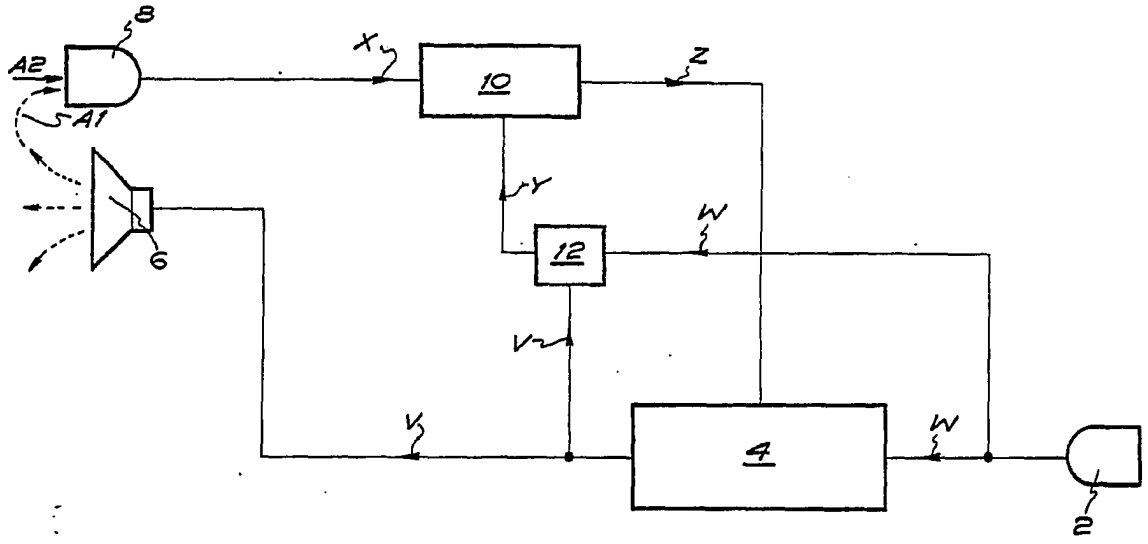
(52) UK CL (Edition J)
H3G GSE G10W G11X G12E G12F
U1S S1719 S2107 S2188

(56) Documents cited
GB 2074408 A GB 2073517 A GB 2029141 A
GB 0485005 A EP 0027519 A1 US 4254303 A

(58) Field of search
UK CL (Edition J) H3G GSE
INT CL⁴ H03G

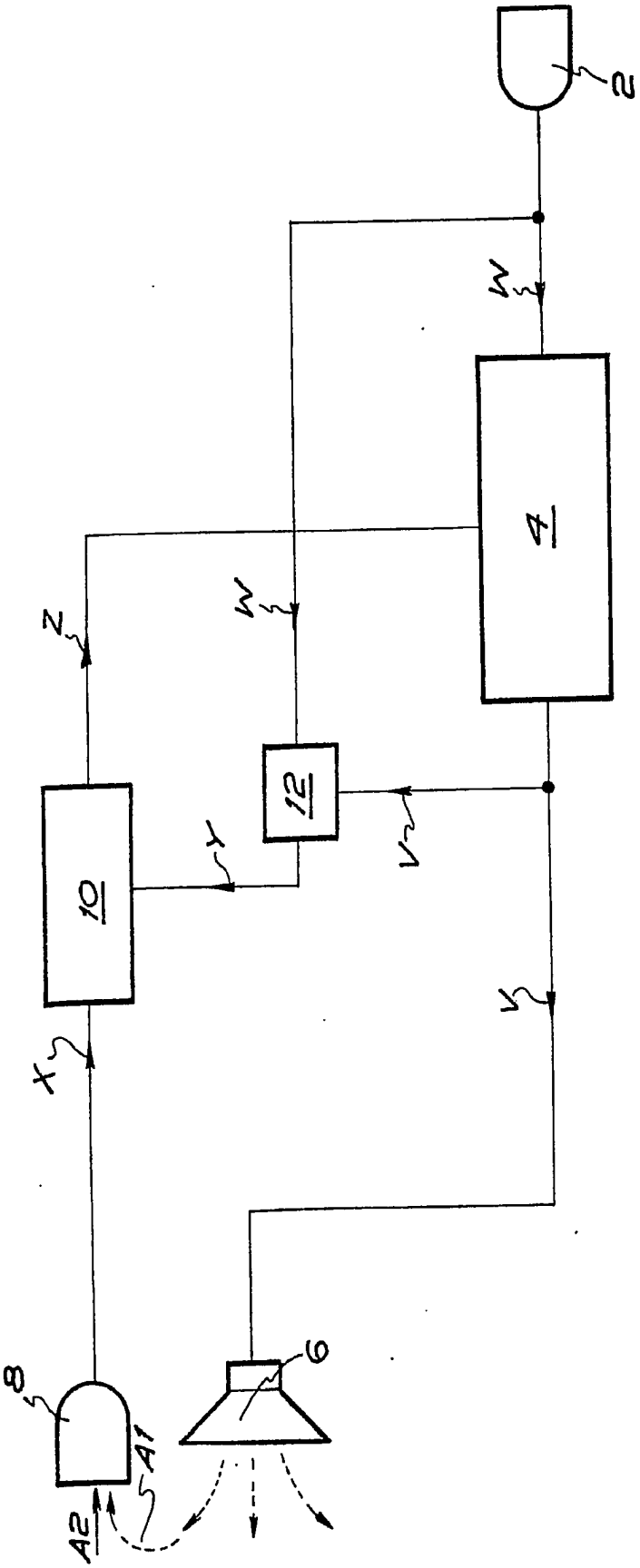
(54) Differential volume adjusters

(57) A public address system includes a microphone (2), a variable gain amplifier (4), at least one loudspeaker (6). The differential volume adjuster includes a second microphone (8) placed in the vicinity of at least one loudspeaker (6), a substractor (10) and an amplitude equalizer (12). The gain of the amplifier (4) is controlled by means of a signal (Z) output from the substractor (10) representing only the level of the ambient noise. The substractor (10) subtracts the magnitude of a signal (Y) output from the equalizer (12) from a signal (X) output from microphone (8) being the combined audio output (A1) from the loudspeaker (6) and the ambient audio noise (A2). The equalizer (12) receives a first input signal (W) from the microphone (2) and a second input signal (V) from the output of the amplifier (4). Thus the gain of the amplifier (4) is varied so as to compensate for varying changes in the level of the background noise to improve the intelligibility of the audio output signal from the loudspeaker (6). The system could be used in a fire alarm unit where microphone (2) is replaced by an electric signal generator energised on detecting a fire and loudspeaker (6) would be replaced by a siren.



GB 2 211 685 A

1-1



"IMPROVEMENTS IN DIFFERENTIAL VOLUME ADJUSTERS".

The present invention relates to a differential volume adjuster for use with an amplifying system. In particular, although not exclusively, it is concerned with reducing the level of background noise experienced in public address systems.

One problem with public address systems is that they are sometimes very difficult to hear, particularly when there is a lot of ambient background noise. This is a very real problem in railway stations for example, where train noises, and other noises created either by the public or station staff, make it very difficult to hear some of the announcements given out over the public address system.

Public address systems consist of a microphone, an amplifier and a loudspeaker. In practice, more than one loudspeaker is used, e.g. at a railway station, and in some cases more than one microphone can be used.

As mentioned above, for a public address system to be effective, it must be intelligible, above the general level of background noise, which may vary considerably over a short period of time.

It is therefore an object of the present invention to overcome partially or wholly the above referred to disadvantage.

According to the present invention there is provided in an amplifying system including an audio electric signal source, variable gain control means and at least one electro-acoustic transducer, means for generating a combined signal being the sum of the background noise and

the electro-acoustic transducer output in the vicinity thereof, means for generating a signal from the output of the audio electric signal source which corresponds to that output from the variable gain control means for transmission to the electro-acoustic transducer, means for subtracting said generated signal from the audio electric signal source output from the combined signal so as to leave a signal whose amplitude represents the true level of the background noise in the vicinity of the electro-acoustic transducer, and means for effecting a control of the gain of the variable gain control means from said signal whose amplitude represents the level of the background noise.

In this way the gain of the variable gain control means can be varied so as to compensate for varying changes in the level of the background noise, whereby the intelligibility of the audio signal output from the electro-acoustic transducer can be greatly improved.

Preferably, the electro-acoustic transducer is a loudspeaker, and the audio electric signal source is a microphone.

The present invention will now be described in greater detail by way of example with reference to the accompanying drawing, wherein the sole figure is a block diagram of one preferred form of differential volume adjuster as applied to a public address sytem.

As shown in the drawing, the public address system includes a microphone 2, a variable gain amplifier 4 and at least one loudspeaker 6, as is conventional. The differential volume adjuster includes a second microphone 8 placed in the vicinity of said at least one loudspeaker, a subtractor 10 and an amplitude equalizer 12. The amplifier 4 is

developed from a "CMOS" voltage controlled amplifier using a NOR gate, and has its gain control from a signal Z output from the subtractor 10. A signal W output from the microphone 2 is supplied to an input of the amplitude equalizer 12. A signal V output from the amplifier 4 is supplied to a second input of the amplitude equalizer 12. The amplitude equalizer outputs a signal Y to an input of the subtractor 10. The second microphone 8, which is placed in close proximity to the loudspeaker 6 receives both an audio signal A1 from the loudspeaker 6 and a signal A2 being an audio signal of the background noise. These two audio signals are combined in the microphone 8 to provide a composit electrical signal X which is applied to a second input of the subtractor 10.

The function of the subtractor 10 is to provide the output signal Z whose magnitude represents the level of the ambient noise. It does this by subtracting the magnitude of the signal Y output from the microphone 2 from the signal X whose magnitude is the combined audio output A1 from the loudspeaker 6 and the ambient audio noise A2. In order to achieve this, it is desirable that the intensity of noise detected by each microphone 2 and 8 should be the same. Thus to ensure equal intensities, the microphone 8 must be situated at a distance from the loudspeaker 6 which ensures that the signal strength produced in the microphone 8 by the loudspeaker 6 is the same as that caused by the announcer in the microphone 2. By subtracting signal Y from signal X in the subtractor 10, the output signal Z represents only the ambient noise.

Accordingly, the gain of the amplifier 4 can be controlled in

direct proportion to the amplitude of signal Z, so that if there is substantially no background noise, the amplitude of the signal Z will be substantially zero, resulting in the gain of the amplifier 4 being normal. In the event of an increase in the magnitude of the signal A2 representing ambient noise, the amplitude of the signal Z increases which causes the gain of the amplifier 4 to increase in correspondance therewith. An inceased audio output results from the loudspeaker 6. Since the signal strength of the audio signal A1 picked up by the microphone 8 increases, a corresponding increase in amplitude of the signal Y must result in order that the signal Z can represent only the ambient noise. This corresponding increase in the amplitude of the signal Y results from the amplitude equalizer 12 which increases the amplitude of the signal output from the microphone 2 in accordance with the increased gain of the amplifier 4 produced by any increase in the amplitude of the signal Z. Thus irrespective of the amplitude of the signal Z, the amplitudes of signals Y and A1 will always substantially cancel each other out, leaving only the magnitude of the signal A2 representing the background noise.

It will be appreciated that the use of the subtractor 10 is not the only way in which one can obtain the signal Z which represents the amplitude of the background noise. The same result can equally well be achieved by means of a mixer or comparator, it being obvious to those skilled in the art what additional circuitry may be involved to achieve the signal Z whose amplitude represents the level of the background noise.

Moreover, the main function of the variable gain amplifier, which as stated above is to increase the output from the loudspeaker 6 when the ambient noise increases, may be performed by some other device, e.g. an attenuator. However, where an attenuator is used in place of a variable gain amplifier, so that the attenuation to the signal W output from the microphone 2 is varied in inverse relation in accordance with the amplitude of the signal Z, it is necessary to utilize amplifiers in the paths of the signals V, W, Y and Z. It will be readily obvious to those skilled in the art how such a circuit should be constructed and arranged to operate in practice such that the subtractor, mixer or comparator outputs only the signal Z representing the amplitude of the background noise for the purpose of controlling the attenuation of the attenuator in inverse relation.

Where a plurality of loudspeakers are employed in a public address system, e.g. at a railway station, a separate microphone may be associated with each speaker, separate channels and variable gain control means being provided for each channel, so that the output of each loudspeaker can be separately controlled in accordance with the level of the background noise in the immediate vicinity thereof.

Thus, by increasing the audio signal strength output by one or more loudspeakers, in accordance with any increase in the level of background noise at the one or more loudspeakers, the information relayed by the public address system remains audible at all locations inspite of any increase in ambient noise at one or more locations. Such a system clearly has advantage in a railway station, where trains may

stop or start from various platforms during an announcement over the public address system.

Whilst the above example has been described in connection with a public address system, the invention has other applications.

For example, the differential volume adjuster and associated amplifying system could be used in an alarm unit such as a fire alarm. In this case the loudspeaker 6 would be replaced by a siren and the microphone 2 by an electrical signal generator which is energized upon one of the detector units in a fire alarm system being actuated.

Another example is in personal stereos of the "Walkman" (RTM) type intended to be used in public places where there may be a considerable amount of background noise. In this case the loudspeaker 6 would be replaced by the headphone of the personal stereo equipment, and the microphone 2 would be omitted and replaced by the audio output of the radio frequency demodulator or the audio output from the tape recorder.

CLAIMS:-

1. An amplifying system including:-

(a) an audio electric signal source;

(b) variable gain control means;

(c) at least one electro-acoustic transducer;

(d) means for generating a combined signal being the sum of the background noise and the electro-acoustic transducer output in the vicinity thereof;

(e) means for generating a signal from the output of the audio electric signal source which corresponds to that output from the variable gain control means for transmission to the electro-acoustic transducer;

(f) means for subtracting said generated signal from the audio electric signal source output from the combined signal so as to leave a signal whose amplitude represents the time level of the background noise in the vicinity of the electric-acoustic transducer; and

(g) means for effecting a control of the gain of the variable gain control means from said signal whose amplitude represents the level of the background noise.

2. An amplifying system according to claim 1, wherein the electro-acoustic transducer is a loudspeaker and wherein the audio electric signal source is a first microphone.

3. An amplifying system according to claim 1 or 2, wherein said combined signal generating means is a second microphone

which is positioned in close proximity to said electro-acoustic transducer.

4. An amplifying system according to any one of the preceding claims, wherein said signal subtraction means comprises a substractor, which receives a first input from the combined signal generating means and a second input from an amplitude equalizer associated with the variable gain control means, the output from the substractor representing the true level of background noise being utilized to control the gain of the variable control means.

5. An amplifying system according to claim 4, wherein said amplitude equalizer receives a first input from the input side of the variable gain control means and a second input from the output side of the variable gain control means.

6. An amplifying system according to claim 2, wherein there are a plurality of loudspeakers, and wherein a corresponding plurality of combined signal generating means are provided each associated with a respective loudspeaker, and wherein a corresponding plurality of separate channels and variable gain control means are provided, whereby the output of each loudspeaker can be separately controlled in accordance with the level of the background noise in the immediate vicinity thereof.

7. An amplifying system according to any one of the

preceding claims, wherein said variable gain control means is a variable gain amplifier developed from a "CMOS" voltage controlled amplifier using a NOR gate.

8. An amplifying system constructed substantially as herein described with reference to and as illustrated in the accompanying drawings.